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Electron tomography – a new perspective for materials microscopy

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Science Lecture Theatre S11, Bldg 25

Abstract

Within materials science and engineering, the push for nanotechnology and the increasing use of nanoscale materials brings with it the need for high spatial resolution imaging and analysis. As the lateral dimensions of a feature approach that of its depth, as is happening for example in many semiconductor fabrication lines, electron microscopy is being pushed towards examining truly 3-dimensional objects and a single projection is not adequate for a complete description. To that end electron tomography has been adapted from the original ideas proposed in the life sciences to meet the needs of the materials scientist working at the nanoscale. Although electron tomography in the life sciences relies on a tilt series of bright field (BF) images exhibiting predominantly mass-thickness contrast, in materials science, for a general crystalline object, diffraction (and Fresnel) contrast very often prohibits the use of (coherent) BF images for electron tomographic reconstruction. Normally, other (incoherent) signals must be used. As such, high-angle annular dark field (HAADF) scanning transmission electron microscopy (STEM) imaging has been developed as the basis for the tomography tilt series and has become the conventional mode for materials-based electron tomography. However, STEM HAADF imaging will not reveal certain important electronic, compositional and structural properties of many materials and so more unconventional modes are also under development. This talk will show examples from both conventional and unconventional electron tomographic experiments including the 3D fractal structure of heterogeneous catalysts using STEM tomography, 3D dislocation arrays using weak-beam tomography, differentiating carbonaceous composite elements using plasmon tomography and the visualisation of 3D electrostatic potentials using holographic tomography.

Visitors are most welcome: Please note the parking arrangements. There is a designated Visitors Car Park (N1) clearly ground-marked by white paint and tickets, at a cost of $1.4/hour for up to 3 hours, are available from a dispensing machine.

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